Aerosol Size Distributions and Analytical Electron Microscopy

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Data from Bruce Anderson and Darrel Baumgardner (FS files) and Tony Strawa, Paul Lawson and Brad Baker (SP files)

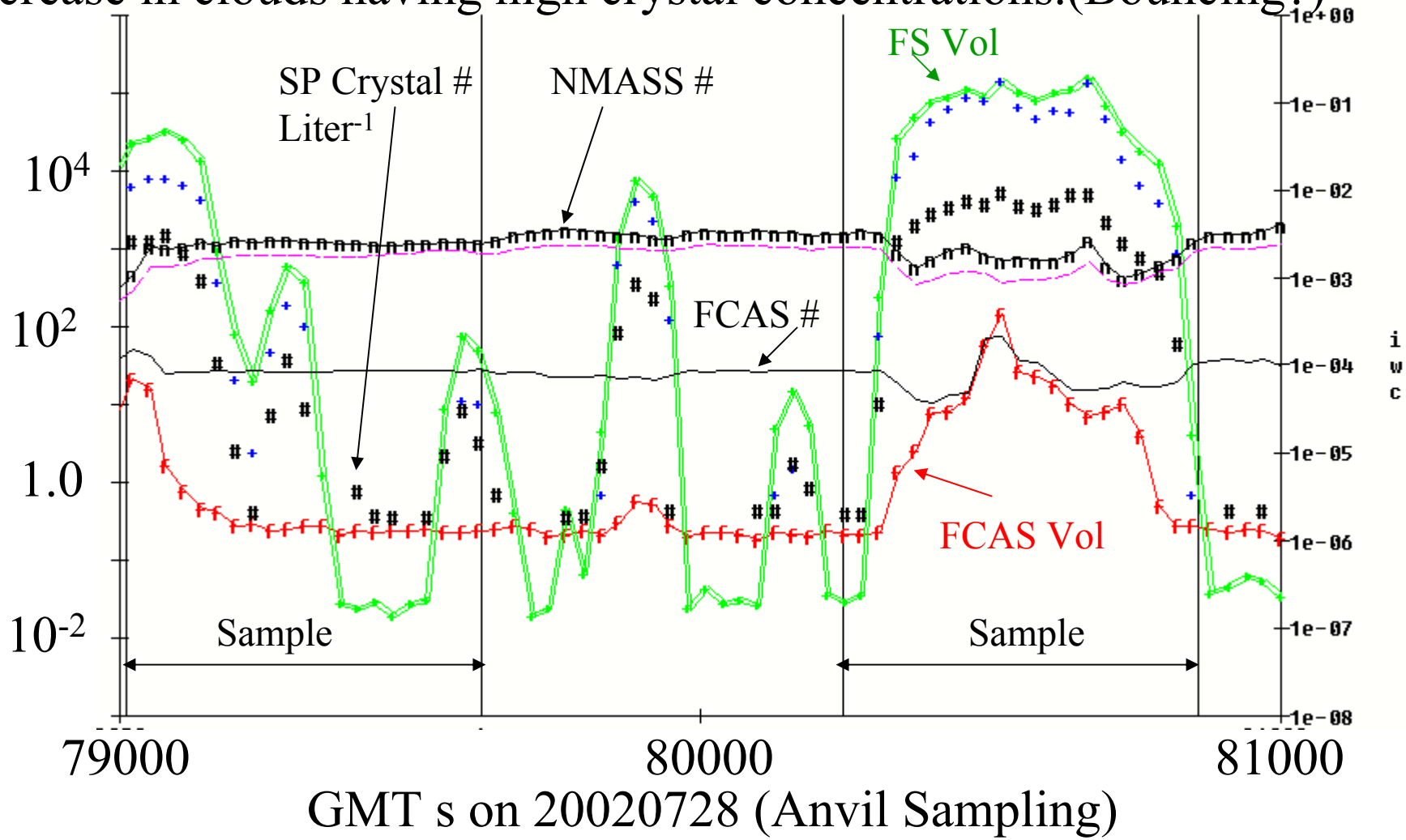
Aerosol Measurements and Sampling from WB57

- FCAS: Light scattering, single particle aerosol spectrometer in pallet. Sizes particles in the ~100 to ~2000 nm diameter range
- NMASS: Five channel, Kelvin sizing spectrometer in the pallet. Cuts sizes at approximately 4, 8, 16, 32, 60 nm.
- MACS collects aerosol on electron microscope grids for later analysis. Operated successfully in last 4 flights.
- Passive, near isokinetic inlets (one apparently containing some Zn.)

What Can We Say About Crystals and Artifacts?

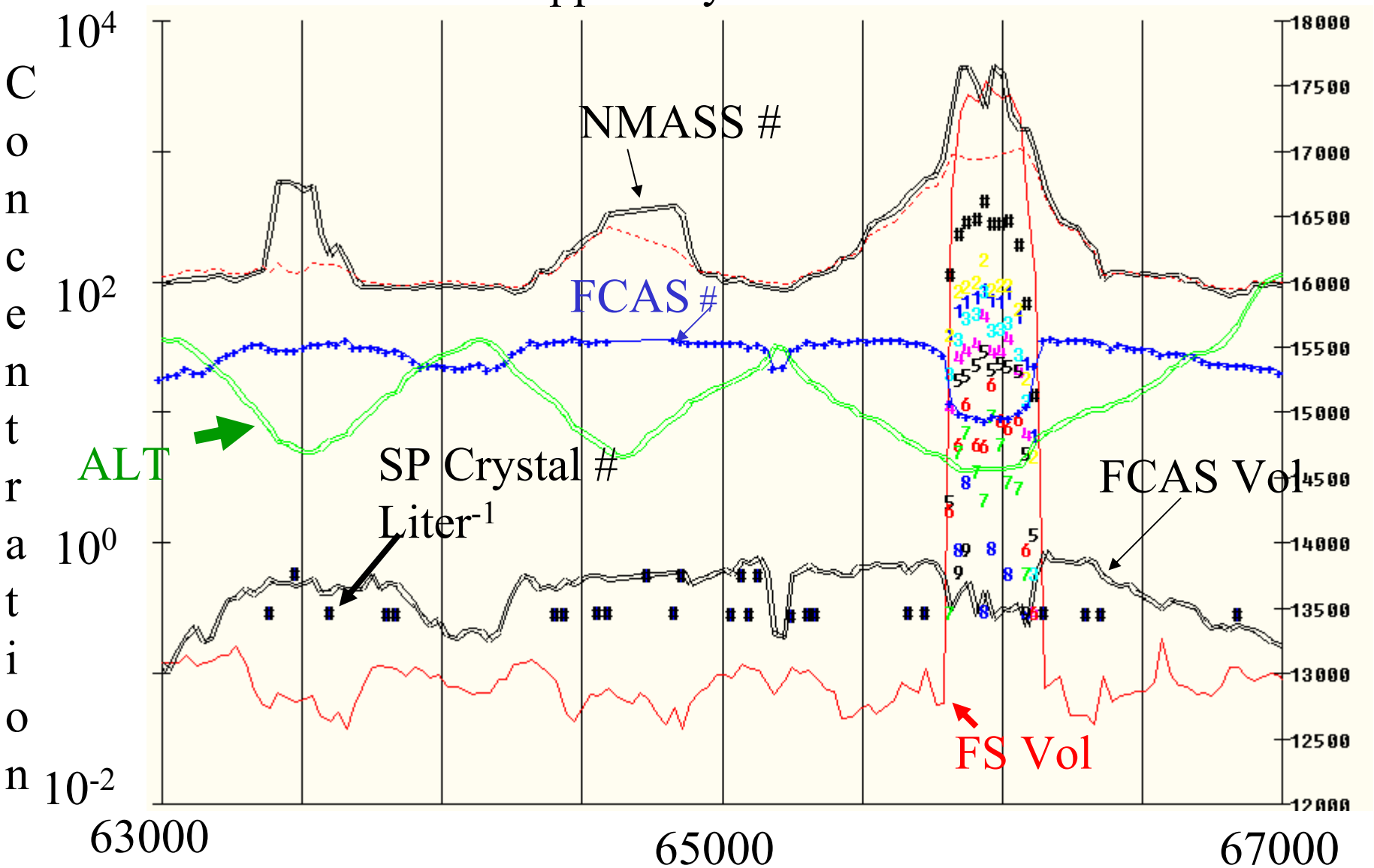
Is there any hope of reporting on interstitial aerosol?

SP and FS agree on location of clouds.
NMASS appears to decrease and FCAS volume appears to increase in clouds having high crystal concentrations.(Bouncing?)



Preliminary Criterion: FS Vol>FCAS Vol implies clouds and these data are excluded.
This may be too conservative. The FCAS and NMASS do not respond to smaller concentrations of crystals.

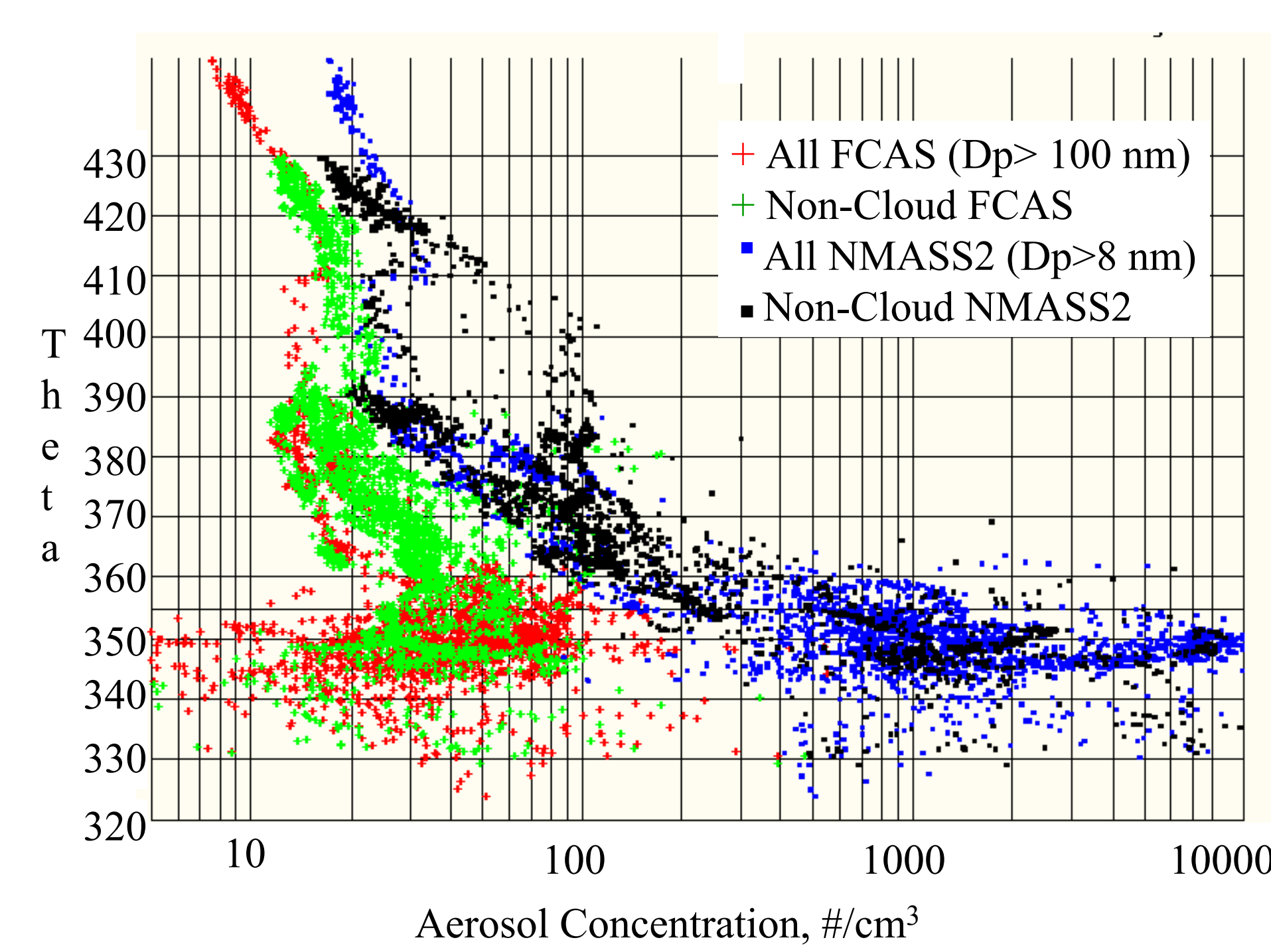
SP and FS agree on location of clouds.
NMASS and FCAS react oppositely to 0728.

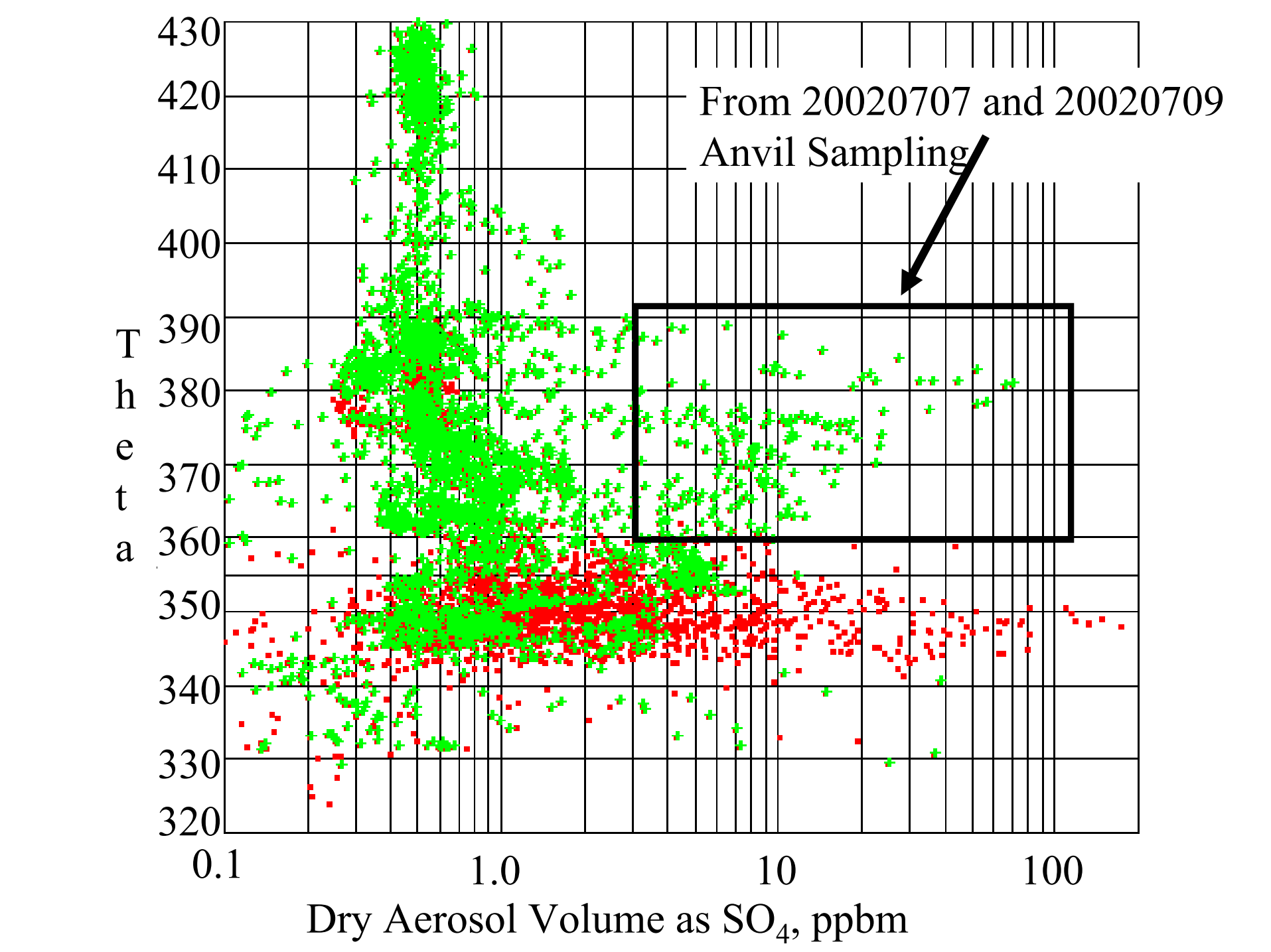


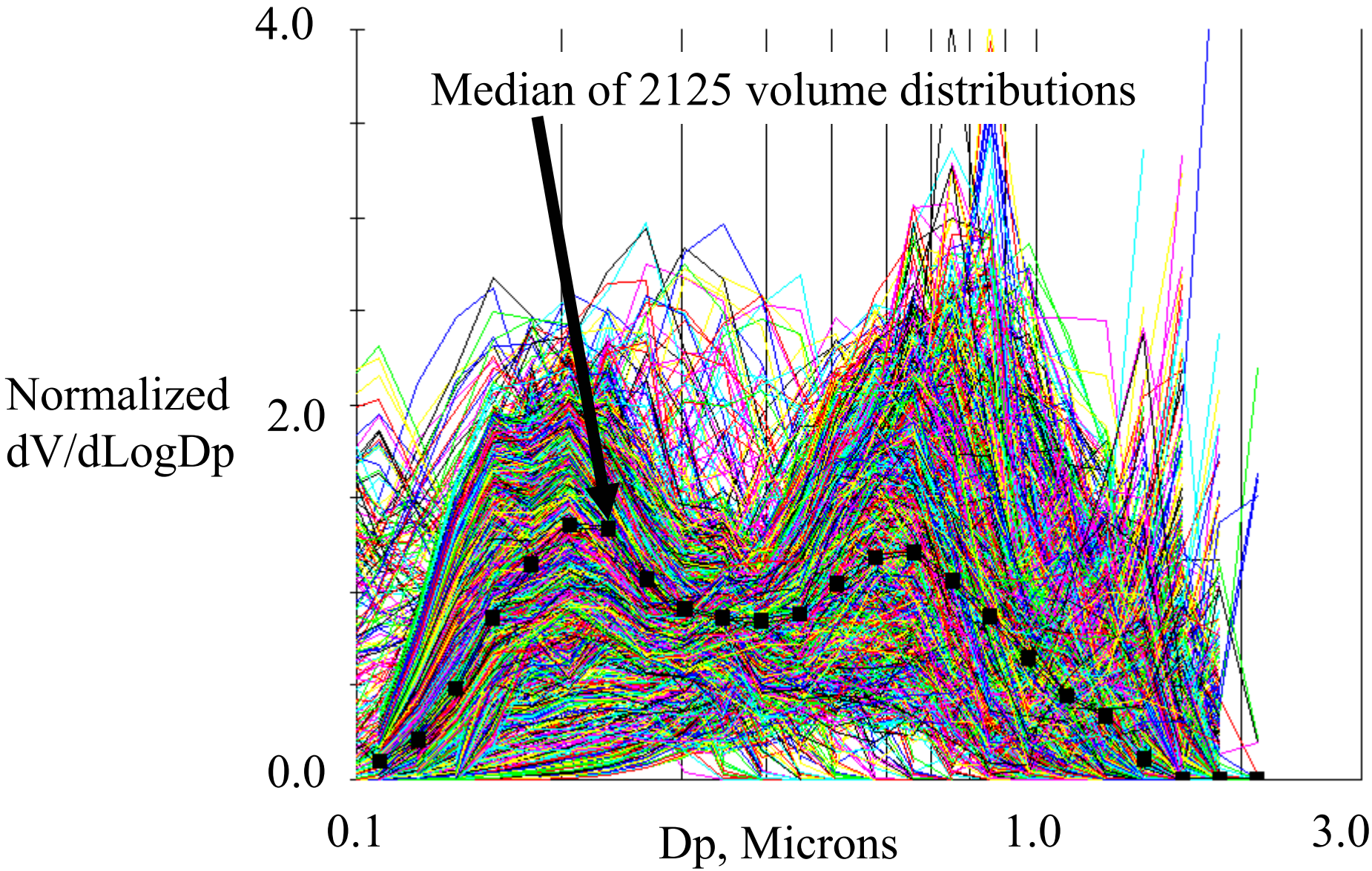
GMT s on 20020726: Southern Trop Probe w/ Cirrus

Preliminary Analysis of Size Distributions and Integral Parameters

- Nuclei mode most important in troposphere
- Lots of variability in the troposphere
- Significant fraction of the mass is carried by a second mode in the submicron aerosol
- Unusually large volumes seen above the anvil on 20020707 out of cloud and in the stratosphere.

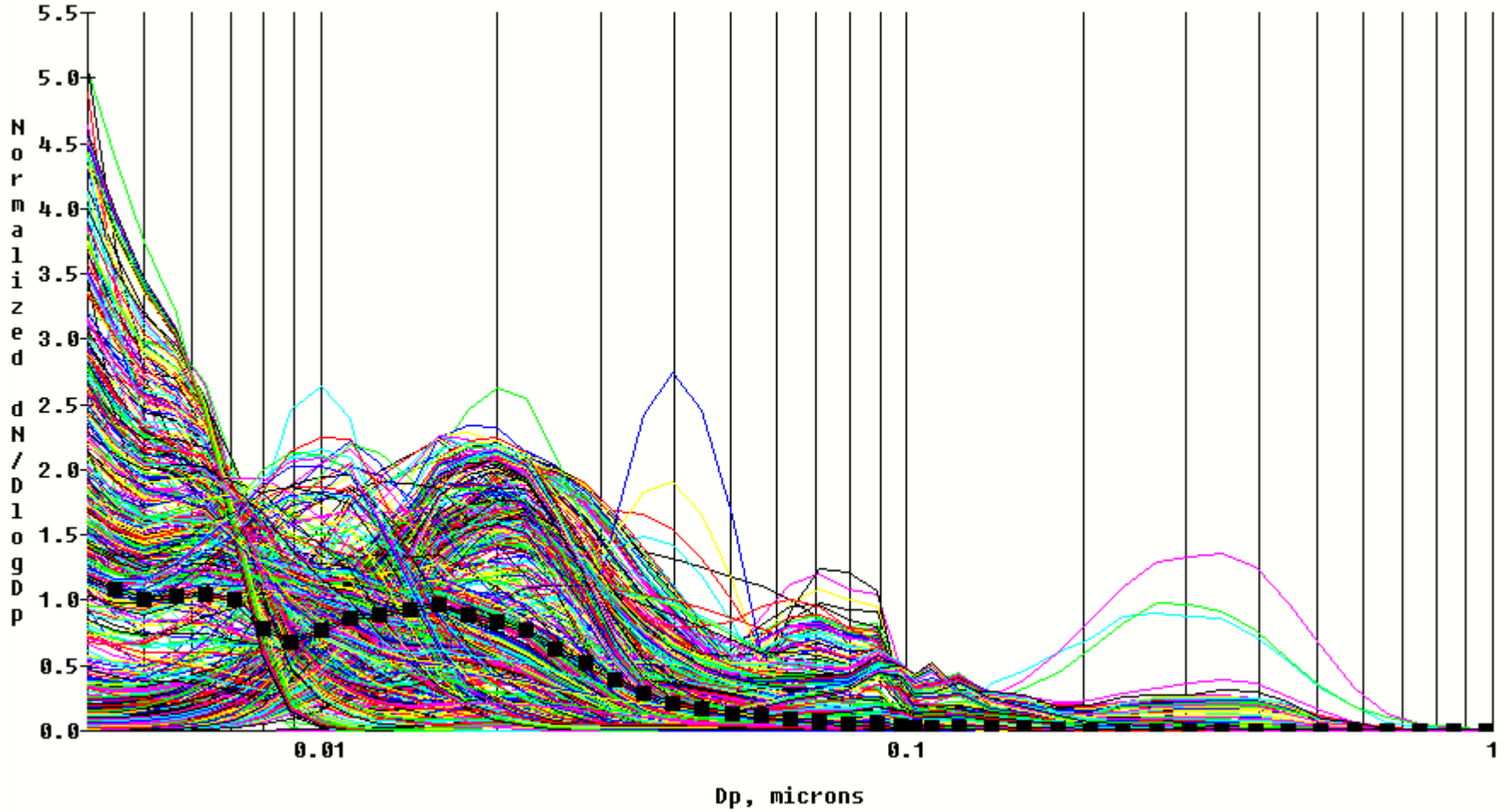

All FCAS (Dp> 100 nm)
Non-Cloud FCAS
All NMASS2 (Dp>8 nm)
Non-Cloud NMASS2
Theta
430
420
410
400
390
380
370
360
350
340
330
320
10
100
1000
10000
Aerosol Concentration, #/cm3


From 20020707 and 20020709
Anvil Sampling
Theta
430
420
410
400
390
380
370
360
350
340
330
320
0.1
1.0
10
100
Dry Aerosol Volume as SO_4, ppbm



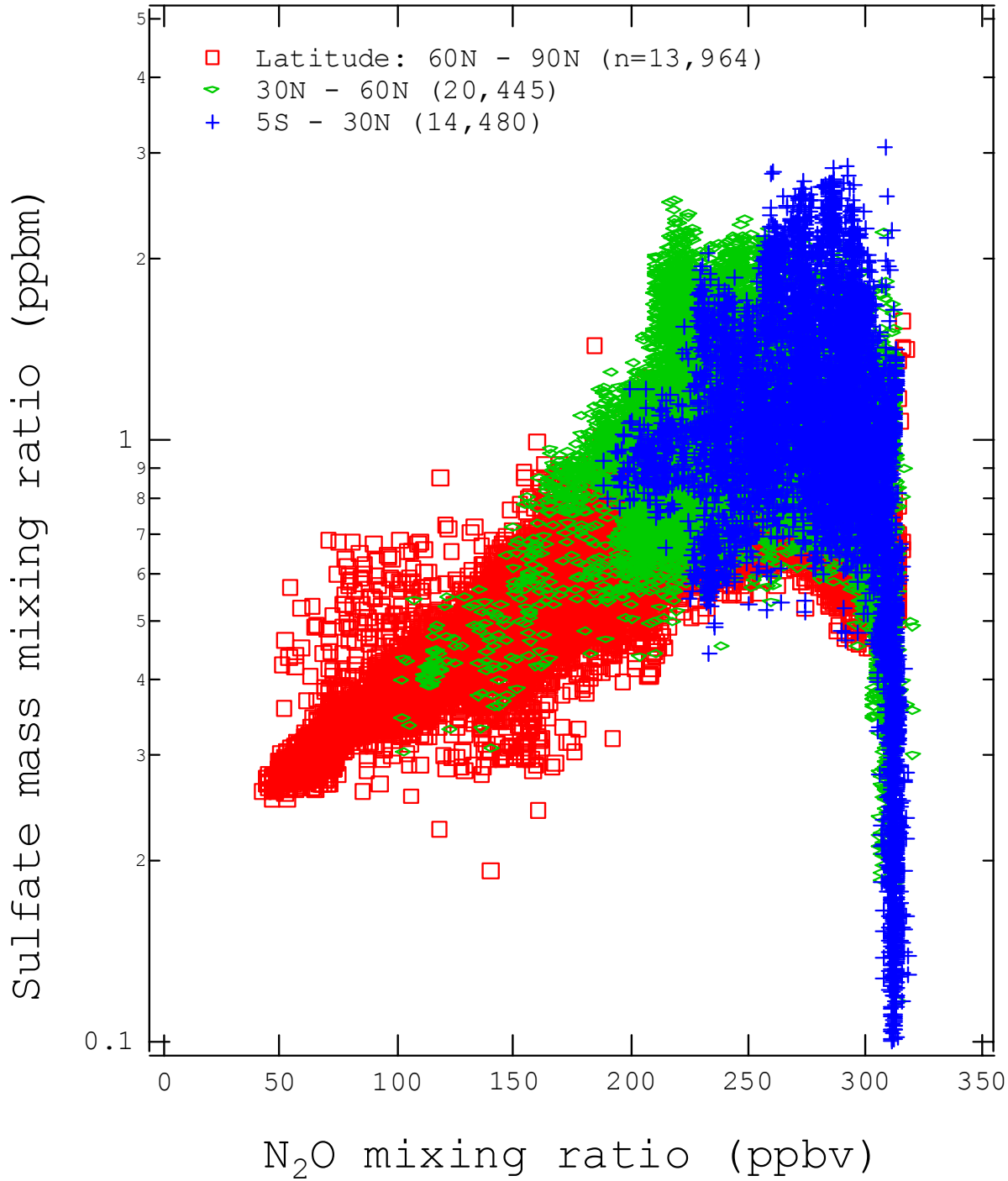
Stratospheric size distributions measured out of cloud
A significant fraction of the mass is in a mode peaking at ~600nm.

590 Normalized, tropospheric number distributions measured outside of clouds

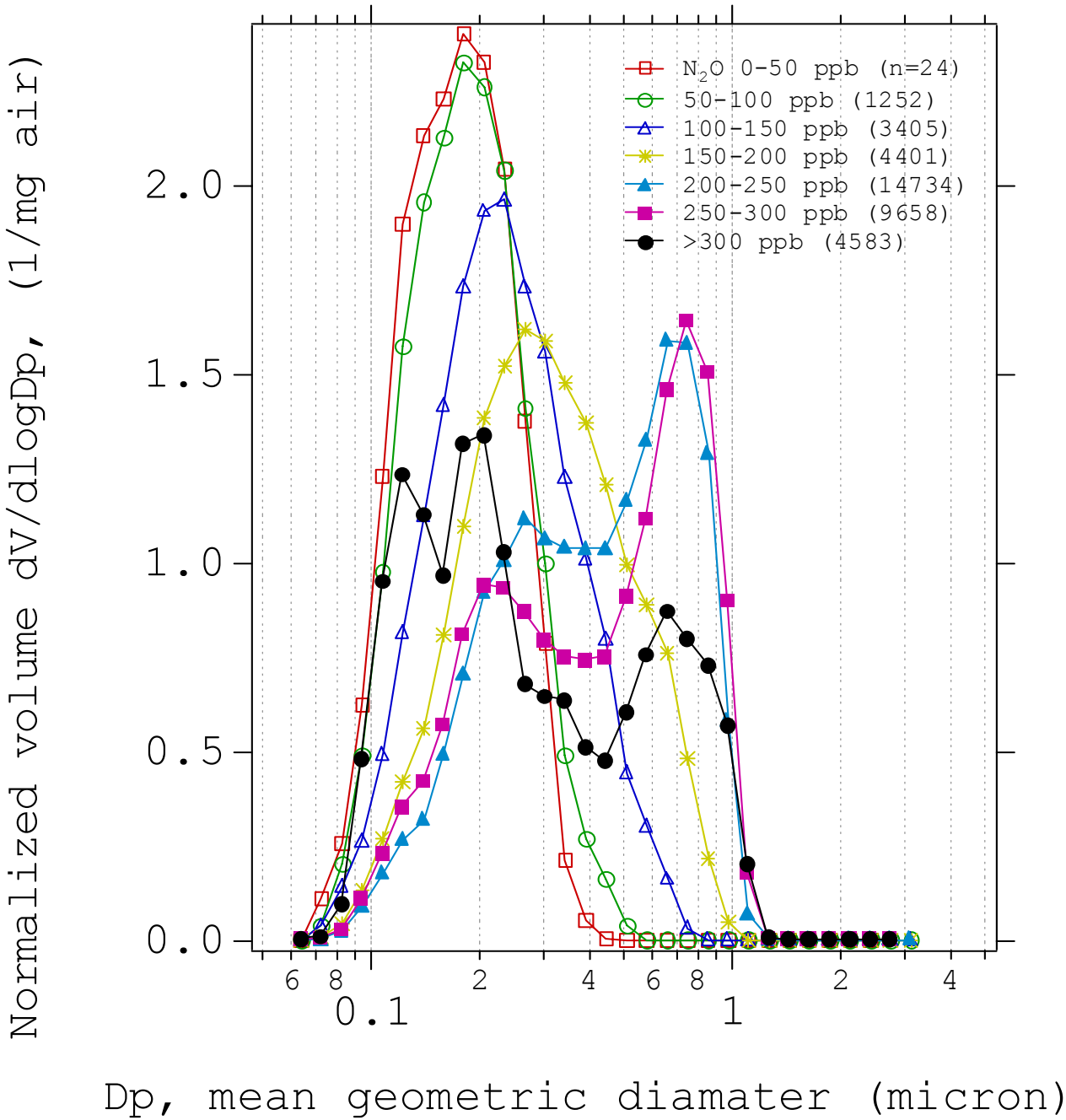


The number is dominated by particles smaller than 100 nm. Several different types of distributions are seen. Some peak below 10 nm others peak around 20 nm. The plotted median tries to reflect both.

Sulfate mass mixing ratio at different latitudes as a function of N_2O mixing ratio. Some CRYSTAL-FACE observations fall outside of previous measurements near the tropopause.



Normalized particle volume concentrations as a function of N_2O mixing ratio suggest particle sedimentation occurs as parcels age. CRYSTAL-FACE observations are consistent with these distributions.



Results of Preliminary Analytical Electron Microscopy at ASU

- Samples viewed:

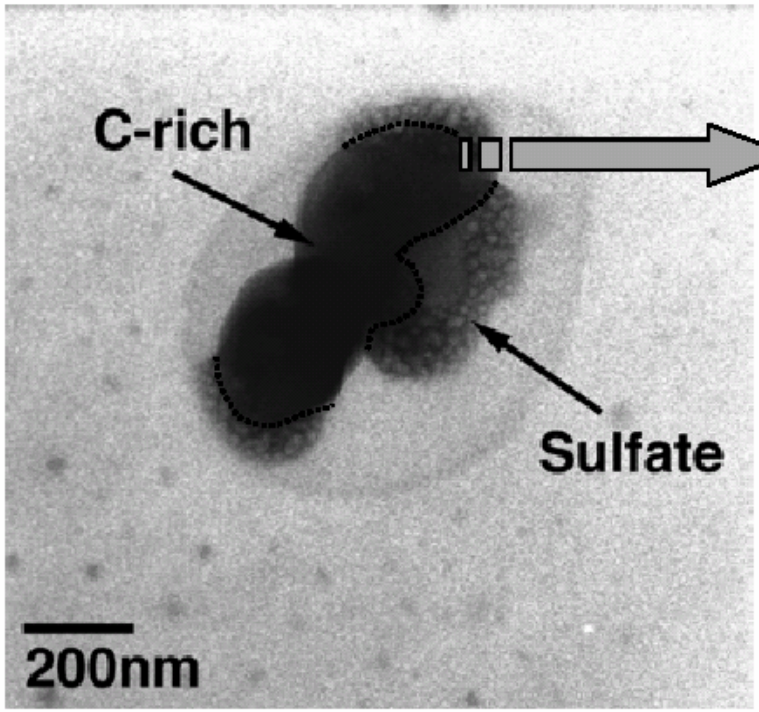
Flight Date	Grids Viewed to Date
20020726	5
20020728	9
20020729	3
20020731	4

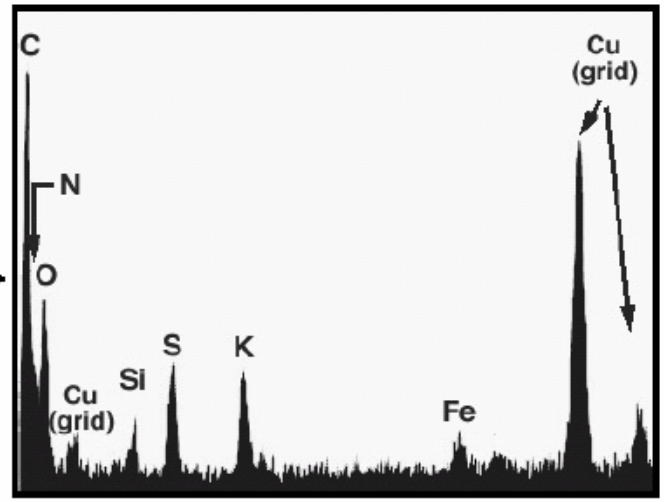
Three Classes of Observations

- Stratospheric samples: Dominated by liquid SO_4. Some clay, carbon rich particle with K and S. Some SO_4 with very small metal inclusions..
- Tropospheric samples: Al and Si rich particles that may not be soil, carbon particles with K and S and larger SO_4 particles than seen in the stratospheric samples.
- Cloud samples: Lots of Zn.
- Internally mixed and coated particles are abundant

Stratospheric Aerosol

- Other types of particles -





From biomass burning?

Also;

- Clay particles
- TM oxides or metal

Example of particle aggregation and coating seen in TEM study.

Conclusions

- Able to measure interstitial aerosol when crystal loading is light
- Observed case of transport that falls outside the envelop of previous observations
- Observed size distributions consistent with location

Analysis for Rest of 2003

- Reprocess FCAS data with post-calibration of new crystal
- Look for variations in TEM analytical results and size distributions with location and conditions of sampling (land, sea, type of cloud)
- Return for second look at grids in order to quantifying observations that are currently qualitative.

Tropical Opportunities in Addition to Improving Understanding of Clouds

- Study the transport of aerosol into the lower stratosphere and its impact on the stratospheric aerosol burden.
- Payload has size, concentration, composition.
- Need to go where particles are going into the stratosphere.